

BAB VI

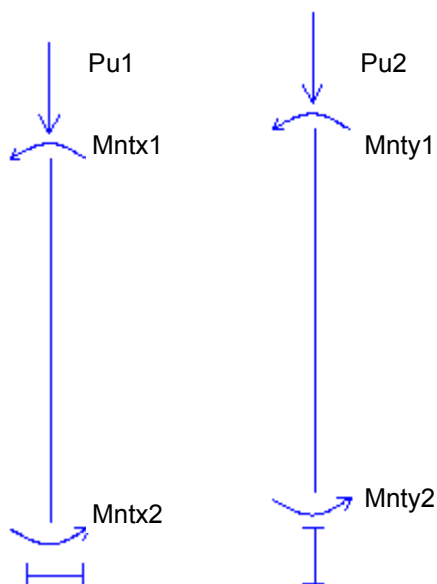
PERENCANAAN KOLOM K1

6.1 Kolom dipakai profil WF 250 x 125 x 6 x 9

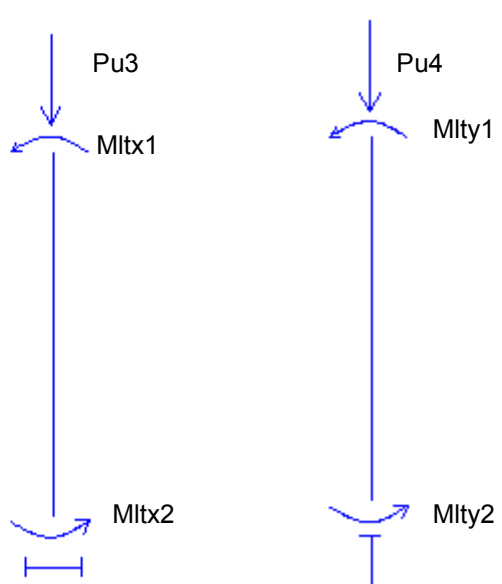
$W := 29.6$	kg/m'	$I_x := 4050$	cm ⁴
$A_g := 37.66$	cm ²	$I_y := 294$	cm ⁴
$d := 250$	mm	$i_x := 10.4$	cm
$b_f := 125$	mm	$i_y := 2.79$	cm
$t_w := 6$	mm	$S_x := 324$	cm ³
$t_f := 9$	mm	$S_y := 47$	cm ³
$r := 12$	mm	$Z_x := 352$	cm ³
$h := d - 2 \cdot (t_f + r) = 208$	mm	$Z_y := 72$	cm ³

BJ 37 : $f_y := 240$ Mpa $E := 2 \cdot 10^5$ Mpa
 $f_u := 370$ Mpa

KOLOM TAK BERGOYANG (D + L)



KOLOM BERGOYANG (GEMPA)



DARI HASIL ANALISA SAP 2000 DIDAPAT :

$Pu1 := 5591.22$ kg $Pu3 := 5591.22$ kg

$Pu2 := 5591.22$ kg $Pu4 := 5591.22$ kg

Tanpa goyangan : $Mntx1 := 1243.16$ kgm
 $Mntx2 := 1243.16$ kgm

Dengan goyangan : $Mltx1 := 1243.16$ kgm
 $Mltx2 := 1243.16$ kgm

$$\Sigma Nu := (14 \cdot Pu1) = 78277.08 \text{ kg}$$

- Untuk arah X

$$I_{xc} := I_x = 4050 \text{ cm}^4 \text{ (kolom)}$$

$$I_{xb} := 1840 \text{ cm}^4 \text{ (balok)}$$

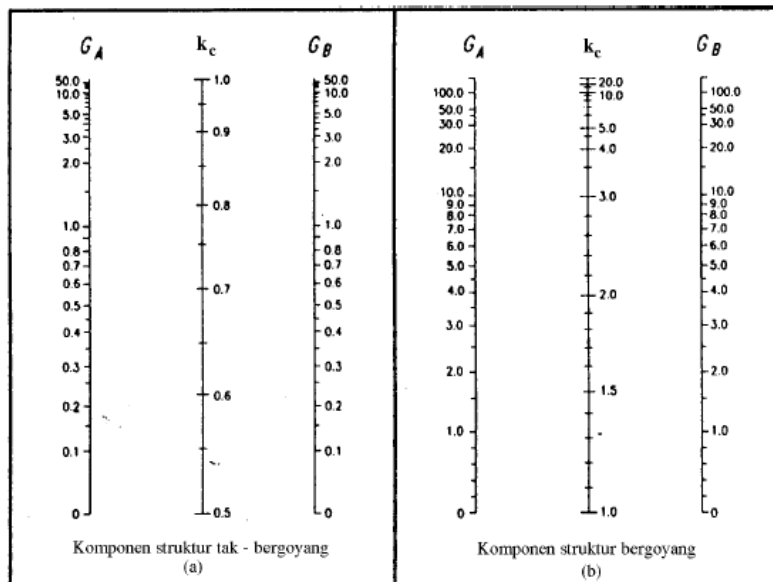
$$G_A := \frac{\left(\frac{I_{xc}}{350} \right)}{\left(\frac{I_{xb}}{350} \right)} = 2.201$$

$$G_B := 1$$

dari nomogram peraturan LRFD (SNI 03-1729-2002) didapatkan :

$$K_{cx1} := 0.81 \text{ tak bergoyang}$$

$$K_{cx2} := 1.45 \text{ bergoyang}$$



- Untuk arah Y

$$I_{yc} := I_y = 294 \text{ cm}^4 \text{ (kolom)}$$

$$I_{yb} := 134 \text{ cm}^4 \text{ (balok)}$$

$$G_A := \frac{\left(\frac{I_{yc}}{350} \right)}{\left(\frac{I_{yb}}{350} \right)} = 2.194$$

$$G_B := 1$$

dari nomogram peraturan LRFD didapatkan :

$$K_{cy1} := 0.81 \text{ tak bergoyang}$$

$$K_{cy2} := 1.45 \text{ bergoyang}$$

- Kontrol Penampang

$$\text{Badan} \quad \frac{h}{t_w} = 34.667 \quad \blacksquare \leq \blacksquare \quad \frac{1680}{\sqrt{f_y}} = 108.444$$

$$\text{Sayap} \quad \frac{b_f}{2 \cdot t_f} = 6.944 \quad \blacksquare \leq \blacksquare \quad \frac{170}{\sqrt{f_y}} = 10.973$$

Penampang kompak $M_{nx} = M_{px}$

- Kontrol Kelangsingan Kolom

A. Kolom bergoyang

$$\lambda_x := \frac{350 \cdot K_{cx2}}{i_x} = 48.798$$

$$\lambda_y := \frac{350 \cdot K_{cy2}}{i_y} = 181.9 \quad \text{Menentukan !!}$$

Tekuk kritis arah y : $\lambda_y > \lambda_x$

$$\lambda_c := \left(\frac{\lambda_y}{\pi} \right) \cdot \sqrt{\frac{f_y}{E}} = 2.006 \quad \dots\dots\dots \lambda_c > 1.2$$

$$\omega := 0.25 \cdot \lambda_c^2 = 1.006$$

$$\Phi P_n := \frac{0.85 A_g \cdot f_y \cdot 10}{\omega} = 76388.026 \quad \text{kg}$$

$$P_u := P_{u1} = 5591.22 \quad \text{kg}$$

$$\frac{P_u}{\Phi P_n} = 0.073 \quad \blacksquare < \blacksquare \quad 0.2 \quad \text{Rumus interaksi 2}$$

$$N_{crx} := \frac{A_g \cdot E \cdot 10 \cdot \pi^2}{\lambda_c^2} = 184784215.059 \quad \text{kg}$$

$$N_{cry} := \frac{A_g \cdot E \cdot 10 \cdot \pi^2}{\lambda_c^2} = 184784215.059 \quad \text{kg}$$

$$\Sigma N_{crsx} := 2 \cdot N_{crx} = 369568430.117 \quad \text{kg}$$

$$\Sigma N_{crsy} := 7 \cdot N_{cry} = 1293489505.41 \quad \text{kg}$$

B. Kolom tak bergoyang

$$\lambda_{x1} := \frac{350 \cdot K_{cx1}}{i_x} = 27.26$$

$$\lambda_{y1} := \frac{350 \cdot K_{cy1}}{i_y} = 101.613$$

$$N_{crbx} := \frac{\pi^2 \cdot A_g \cdot E \cdot 10}{\lambda_{x1}^2} = 27270326.195 \quad \text{kg}$$

$$N_{crby} := \frac{\pi^2 \cdot A_g \cdot E \cdot 10}{\lambda_{y1}} = 7315789.431 \quad \text{kg}$$

- Momen Ultimate

- Terhadap sumbu X

$$C_{m1} := 0.6 - 0.4 \cdot \left(\frac{M_{ntx2}}{M_{ntx1}} \right) = 0.2$$

$$\delta_{bx} := \frac{C_{m1}}{1 - \left(\frac{P_{u1}}{N_{crbx}} \right)} = 0.2 \quad \blacksquare < \blacksquare 1$$

$$\delta_{bx} := 0.2$$

$$\delta_{sx} := \frac{1}{1 - \left(\frac{6 \cdot P_{u1}}{\sum N_{crsx}} \right)} = 1$$

$$M_{ux} := \delta_{bx} \cdot M_{ntx1} + \delta_{sx} \cdot M_{ltx1} = 1491.905 \quad \text{kgm}$$

- Kontrol Momen Nominal

Kontrol local buckling

$$\text{Badan} \quad \frac{h}{t_w} = 34.667 \quad \blacksquare \leq \blacksquare \quad \frac{1680}{\sqrt{f_y}} = 108.444$$

$$\text{Sayap} \quad \frac{b_f}{2 \cdot t_f} = 6.944 \quad \blacksquare \leq \blacksquare \quad \frac{170}{\sqrt{f_y}} = 10.973$$

$$\lambda_r := \frac{370}{\sqrt{240 - 70}} = 28.378 > \lambda = 9.375 \quad \text{Penampang kompak!!}$$

Terhadap sumbu x

$$M_{nx} := Z_x \cdot f_y \cdot 10 = 844800 \quad \text{kgcm}$$

$$M_y := S_x \cdot f_y \cdot 10 = 777600 \quad \text{kgcm}$$

$$M_{nx} = 844800 \quad \text{kgcm} \quad \blacksquare \leq \blacksquare \quad 1.5 \cdot M_y = 1166400 \quad \text{kgcm}$$

Terhadap sumbu y

$$M_{ny} := Z_y \cdot f_y \cdot 10 = 172800 \quad \text{kgcm}$$

- Kontrol lateral buckling

$$L_b := 100 \quad \text{cm}$$

$$L_p := 1.76 \cdot i_y \cdot \sqrt{\frac{2 \cdot 10^5}{f_y}} = 141.751 \quad \text{cm}$$

$$h_w := h - 2 \cdot (r + t_f) = 166 \quad \text{mm}$$

$$J := \frac{(h_w - 2 \cdot t_f)}{3 \cdot 10^4} \cdot t_f^3 + \frac{2}{3 \cdot 10^4} \cdot b_f \cdot t_f^3 = 9.671 \quad \text{cm}^4$$

$$I_w := \frac{I_y \cdot (h - t_f)^2}{4 \cdot 100} = 29106.735 \text{ cm}^6$$

$$x_1 := \frac{\pi \cdot \sqrt{\frac{(2 \cdot 10^6 \cdot 0.8 \cdot 10^6 \cdot J \cdot A_g)}{2}}}{Z_x} = 152348.097 \text{ kg/cm}^2$$

$$x_2 := 4 \cdot \left(\frac{Z_x}{0.8 \cdot 10^6} \right)^2 \cdot \frac{I_w}{I_y} = 0.000077 \left(\frac{\text{cm}^2}{\text{kg}} \right)^2$$

$$L_R := i_y \cdot \left(\frac{x_1}{2400 - 700} \right) \cdot \sqrt{1 + \sqrt{1 + x_2 \cdot (2400 - 700)^2}} = 997.578 \text{ cm}$$

$L_b < L_p < L_r$ bentang pendek

- Kontrol Interaksi beam column

$$\left(\frac{P_u}{\Phi P_n} \right) + \left(\frac{M_{ux} \cdot 100}{0.9 \cdot M_{nx}} \right) = 0.269 \leq 1$$

Jadi H 250 x 125 x 6 x 9 dapat digunakan sebagai profil kolom